Energy and Power Group

UNIVERSITY OF OXFORD

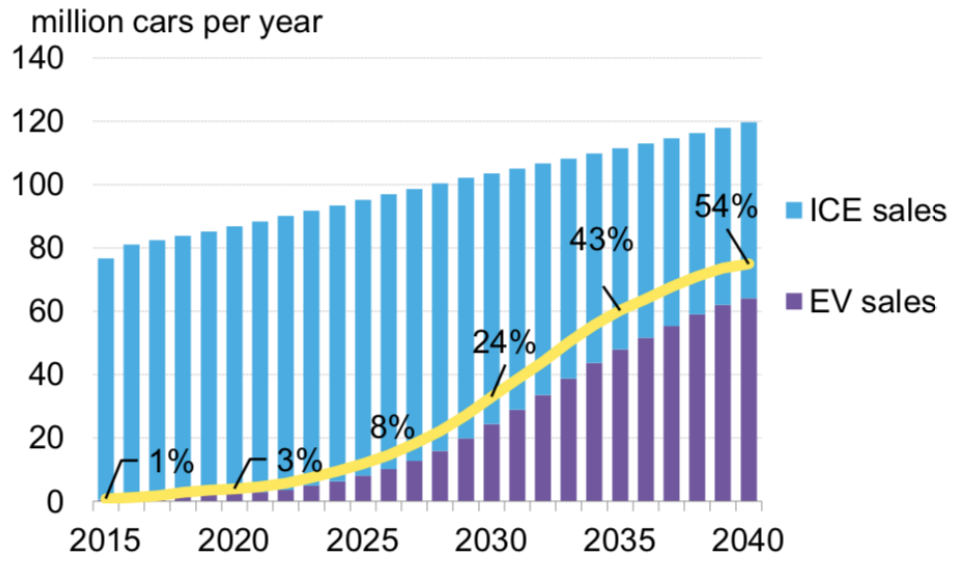
e-Mobility Integration

Dr Katherine Collett

- What might EV uptake look like?
- Where will we charge?
- How will this impact the electricity grid?

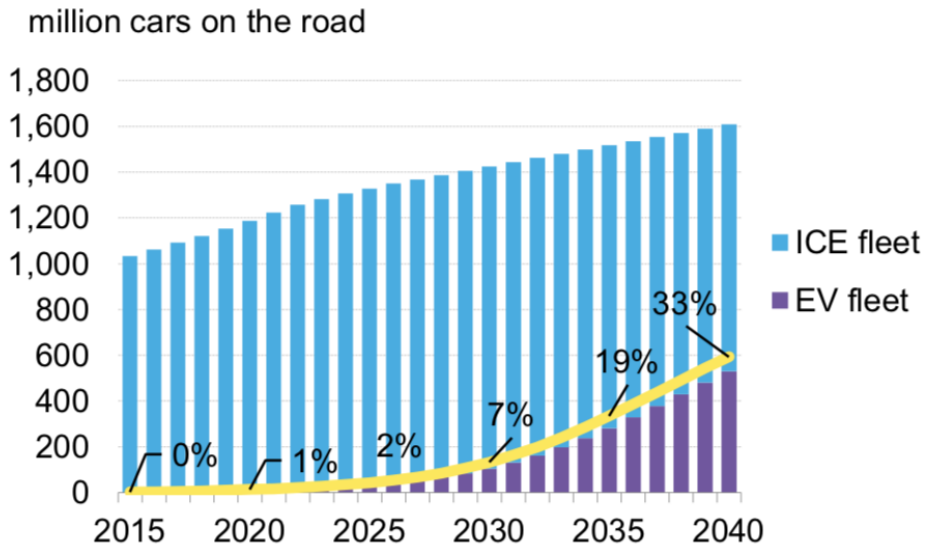
Global EV forecast market growth

Figure 1: Annual global light duty vehicle sales



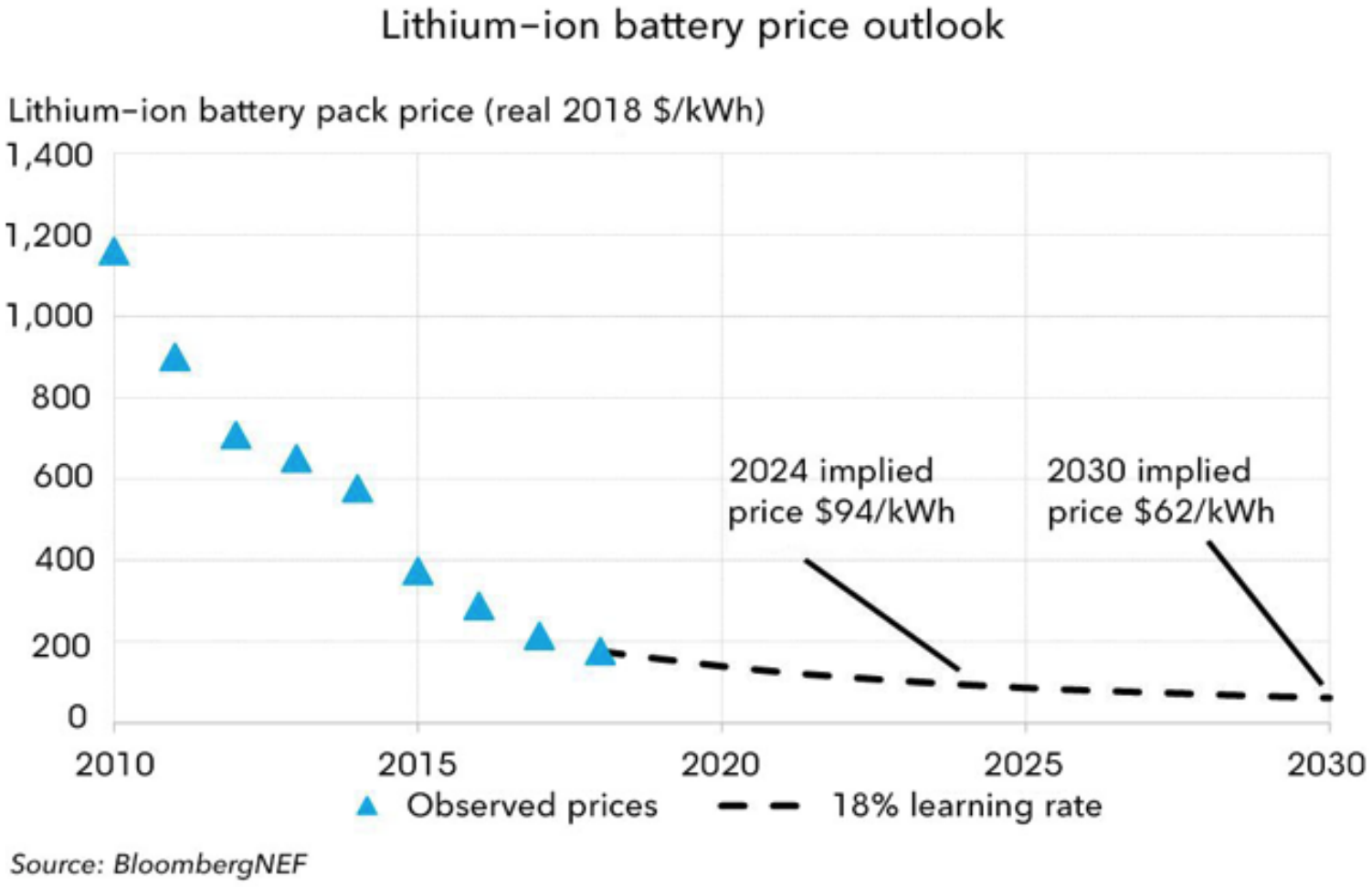
Source: Bloomberg New Energy Finance

Figure 2: Global light duty vehicle fleet

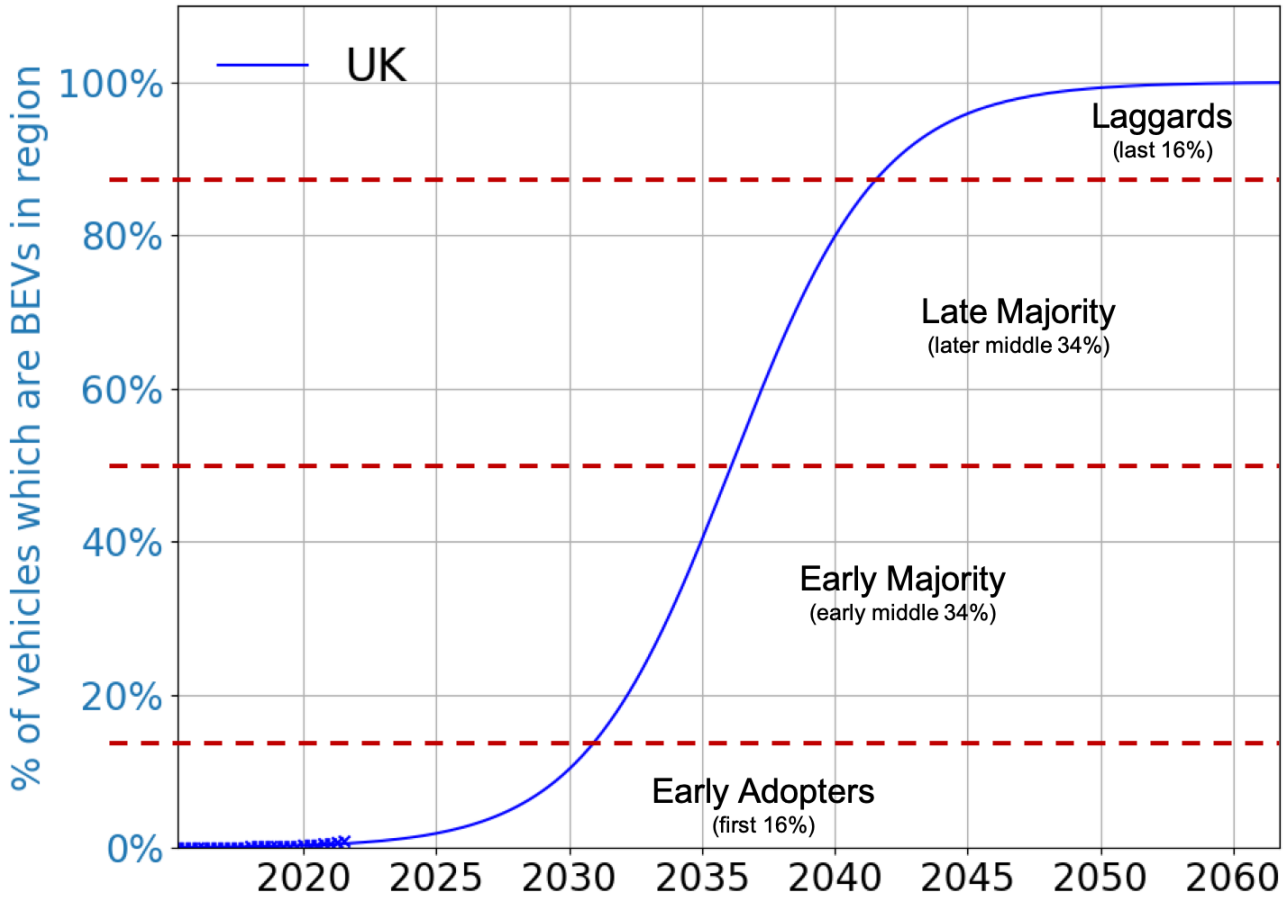


Source: Bloomberg New Energy Finance

Enabled by the falling price of batteries

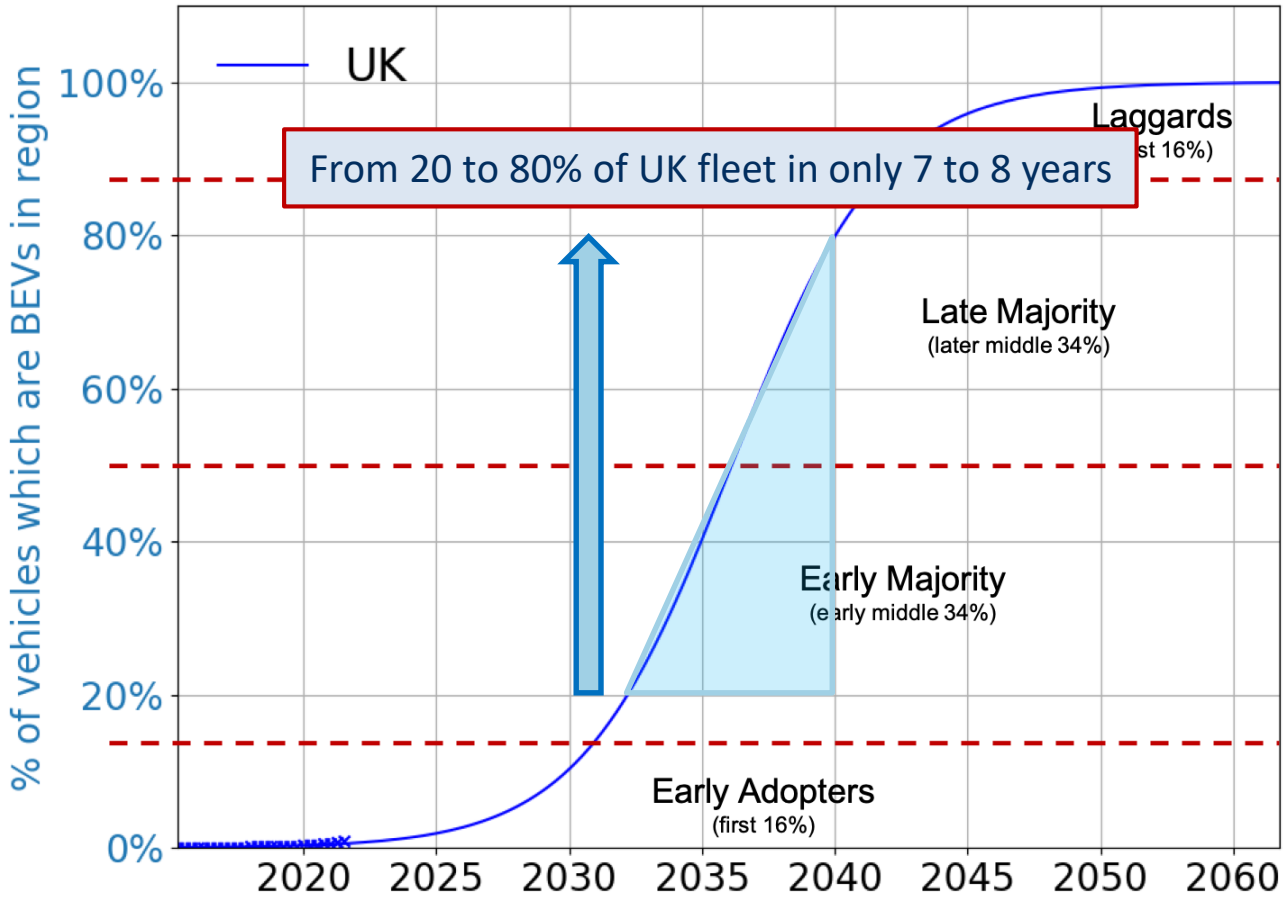


Adoption of new tech is rarely linear



Forecast based on DfT data 2021 Q3

How fast will EV uptake likely be?

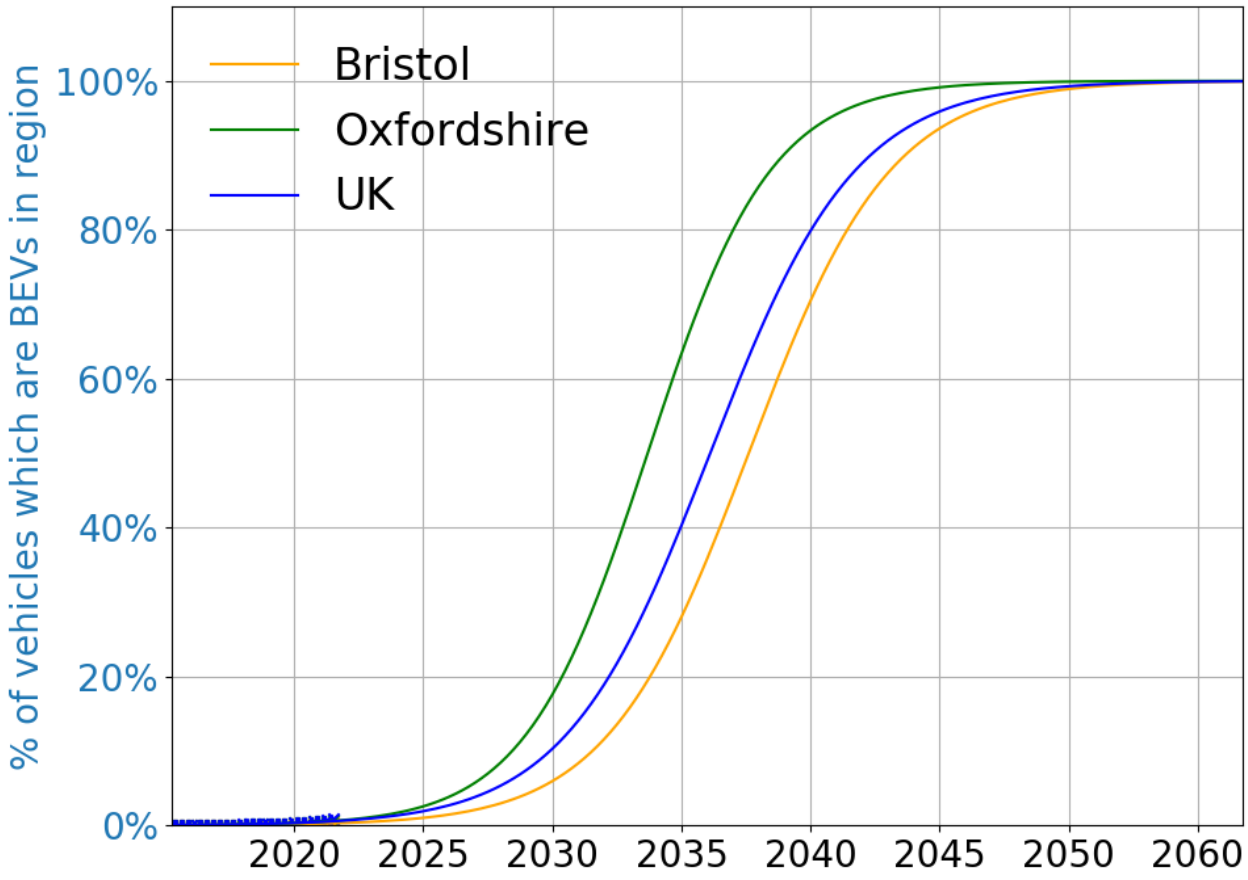


Forecast based on DfT data 2021 Q3

Visit: https://github.com/EPGOxford/SCATE

Regional EV uptake from SCATE

S-Curve Adoption Tool for EVs



Forecast based on DfT data 2021 Q3

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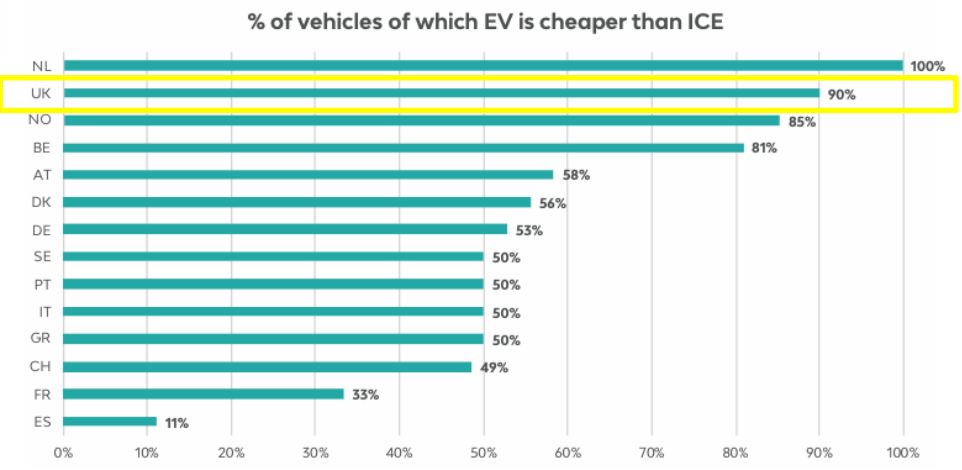
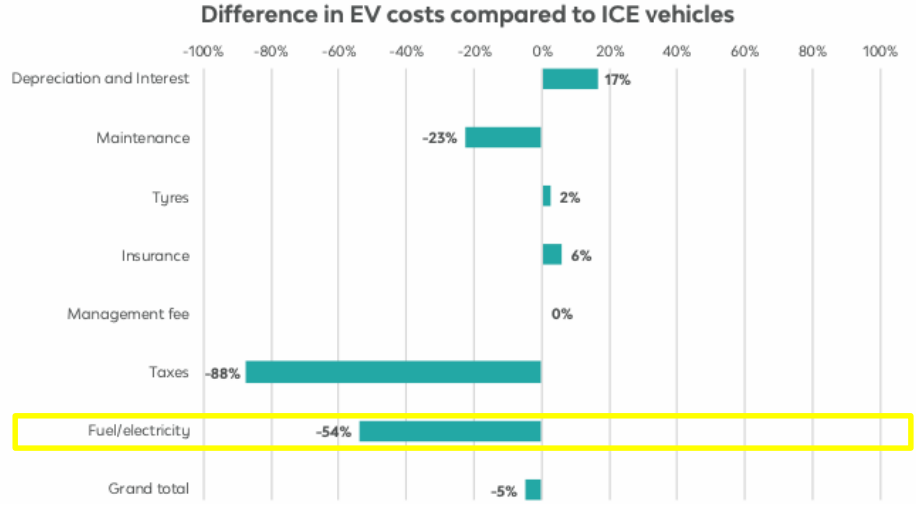
EV total Cost of Ownership



The graph shows the percentage of scenarios in which the TCO is lower for the EV compared to the ICE vehicle. For example, the EV has a lower cost than the ICE in 85% of the scenarios in Norway. As the data shows, there are many differences per country. The majority of countries have a wide range of scenarios with a lower TCO for EVs.

The higher the mileage on a vehicle, the greater the fuel savings.



This data shows that, on average, the costs of an EV are actually 5% lower than for a similar ICE vehicle.

LeasePlan, *The Total Cost of Ownership of Electric Vehicles* , 2019

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EV Chargers

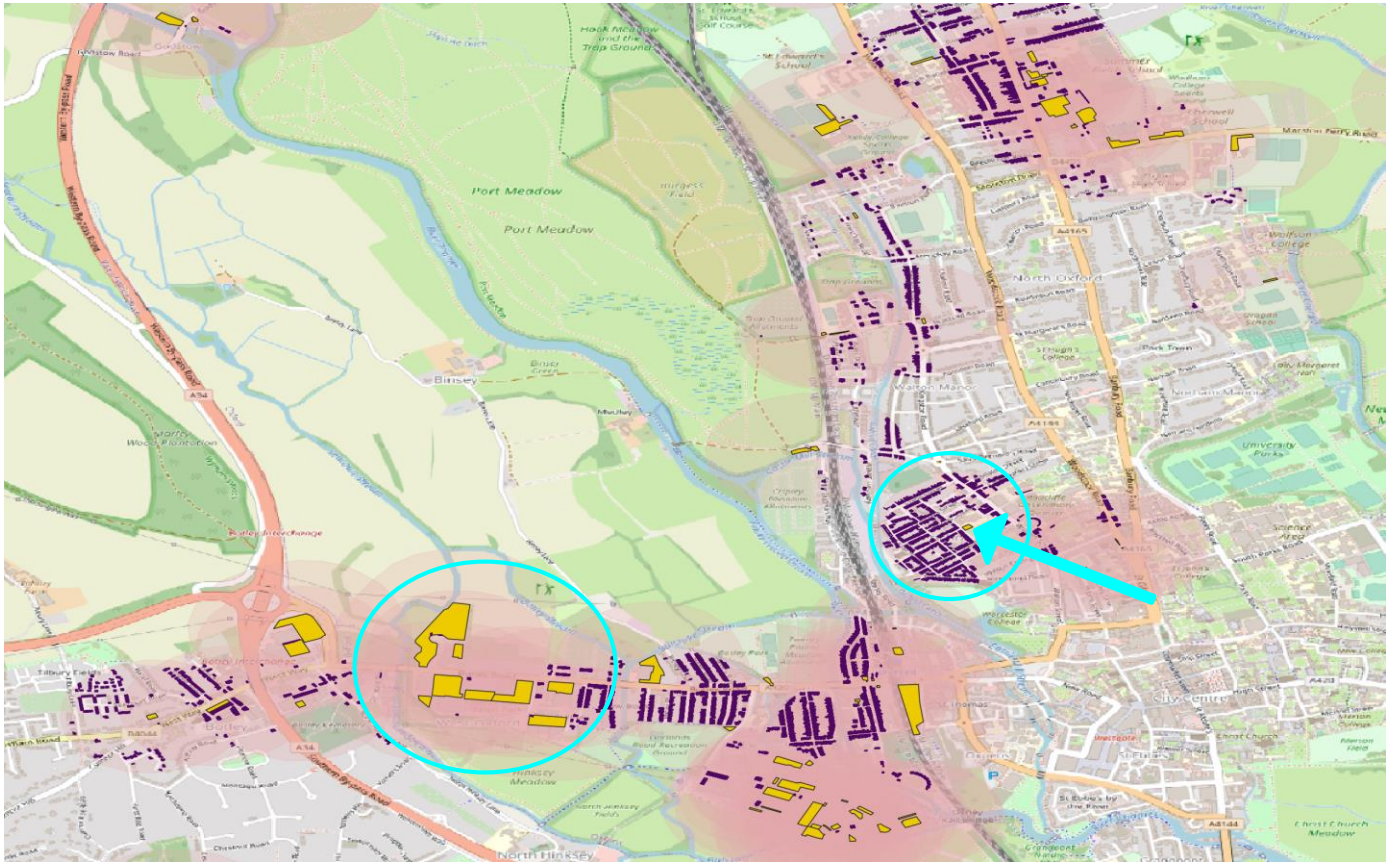
Photo by dcbel on Unsplash

Photo credit: **Marco Verch**

We will need more public chargers for those without off-street parking

For example, in car parks

The Geospatial Evaluator for EV Charging in Car Parks Overnight



Visit: https://github.com/EPGOxford/GECCO

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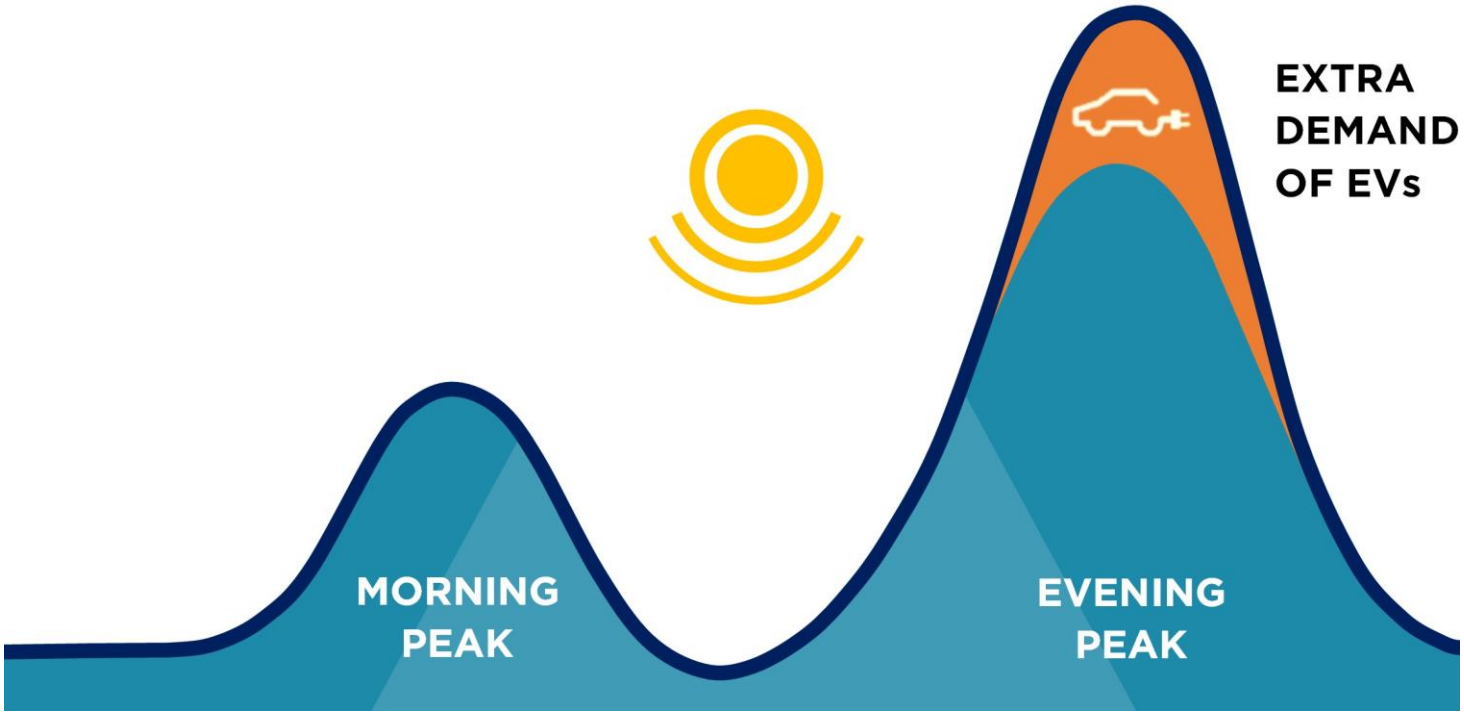
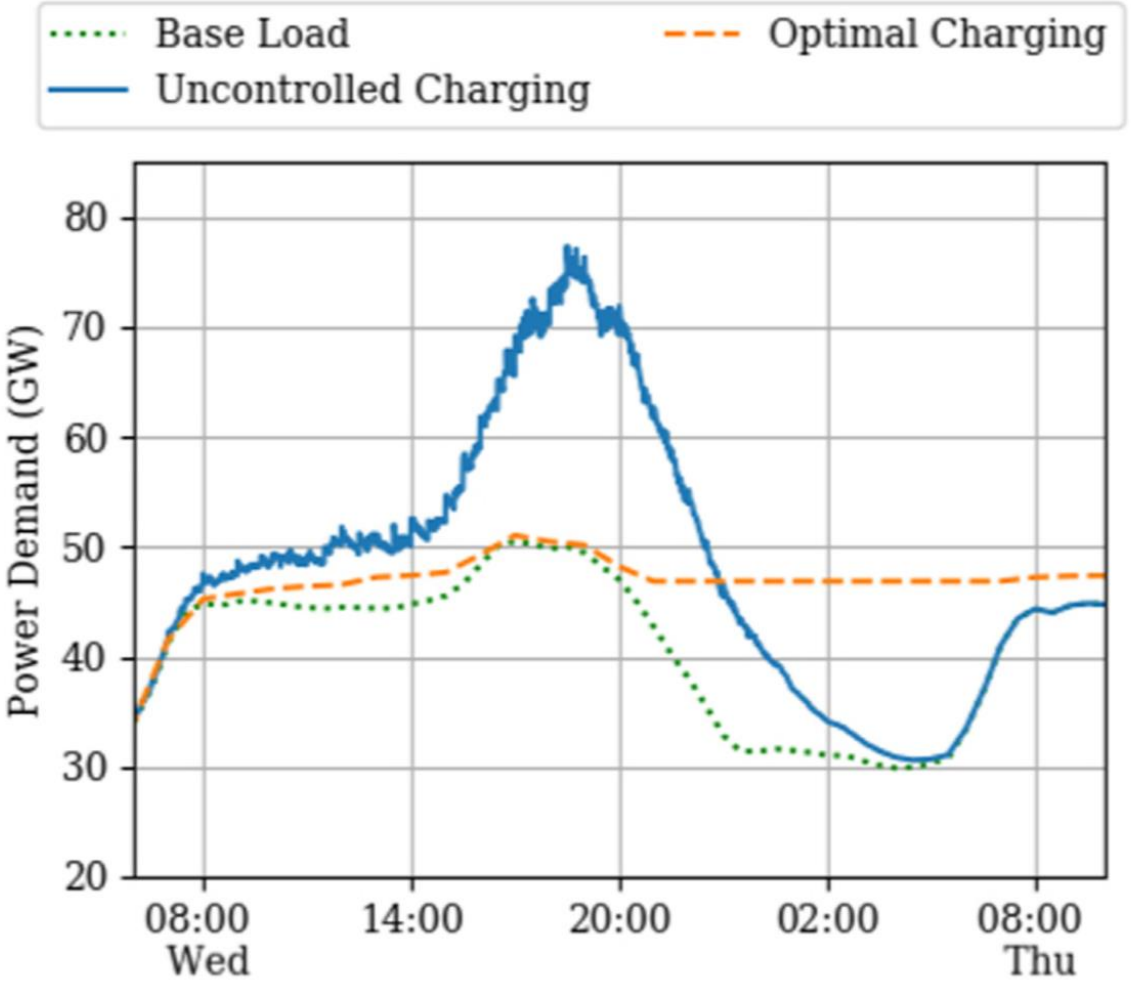
Electric Vehicle Uncontrolled Charging



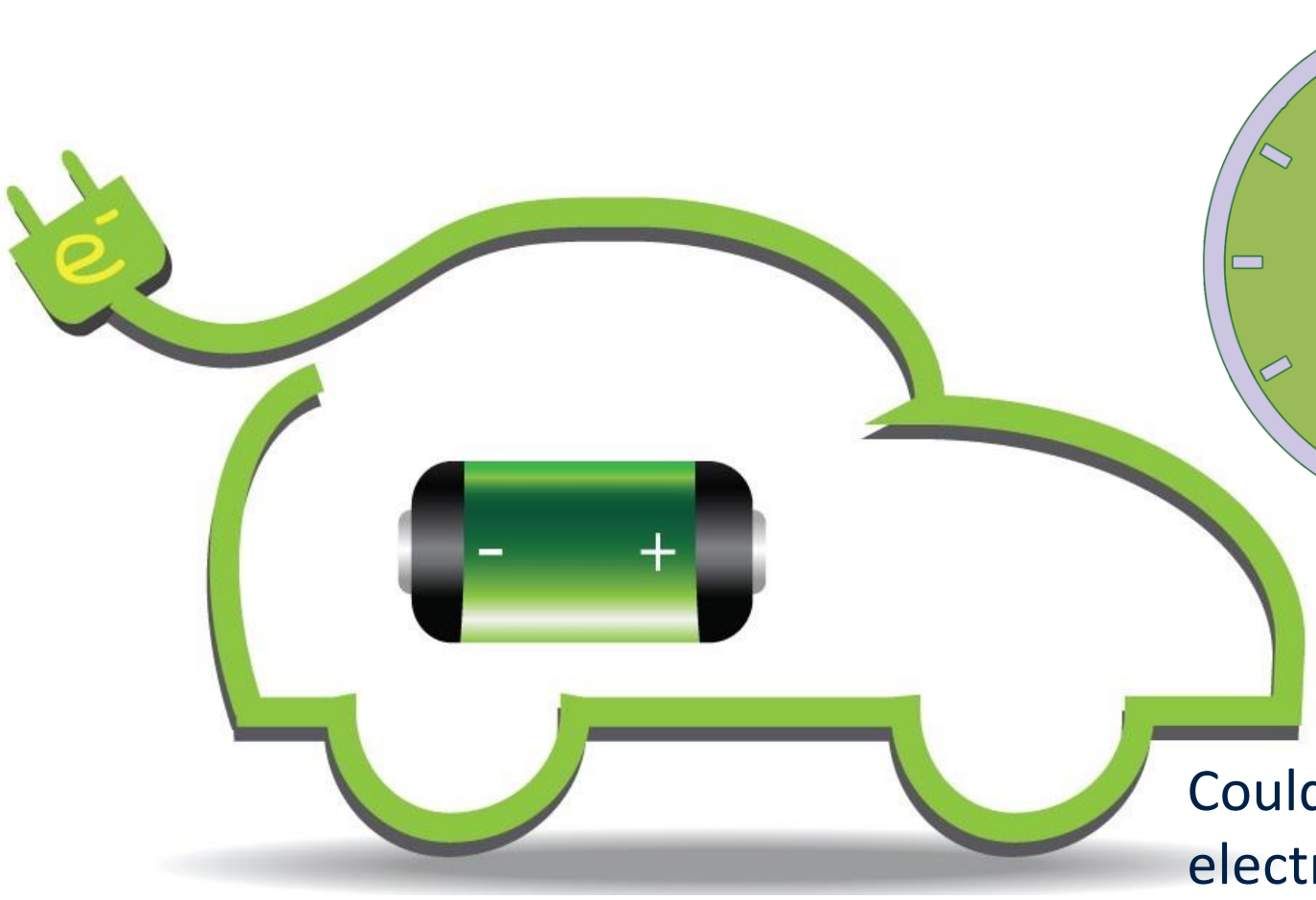
Electric Vehicle Smart Charging

No increase in max power demand



Crozier et al., 2018, Energy Policy 118, pp. 474-481.

Every electric vehicle contains a battery



Parked 96% of the time

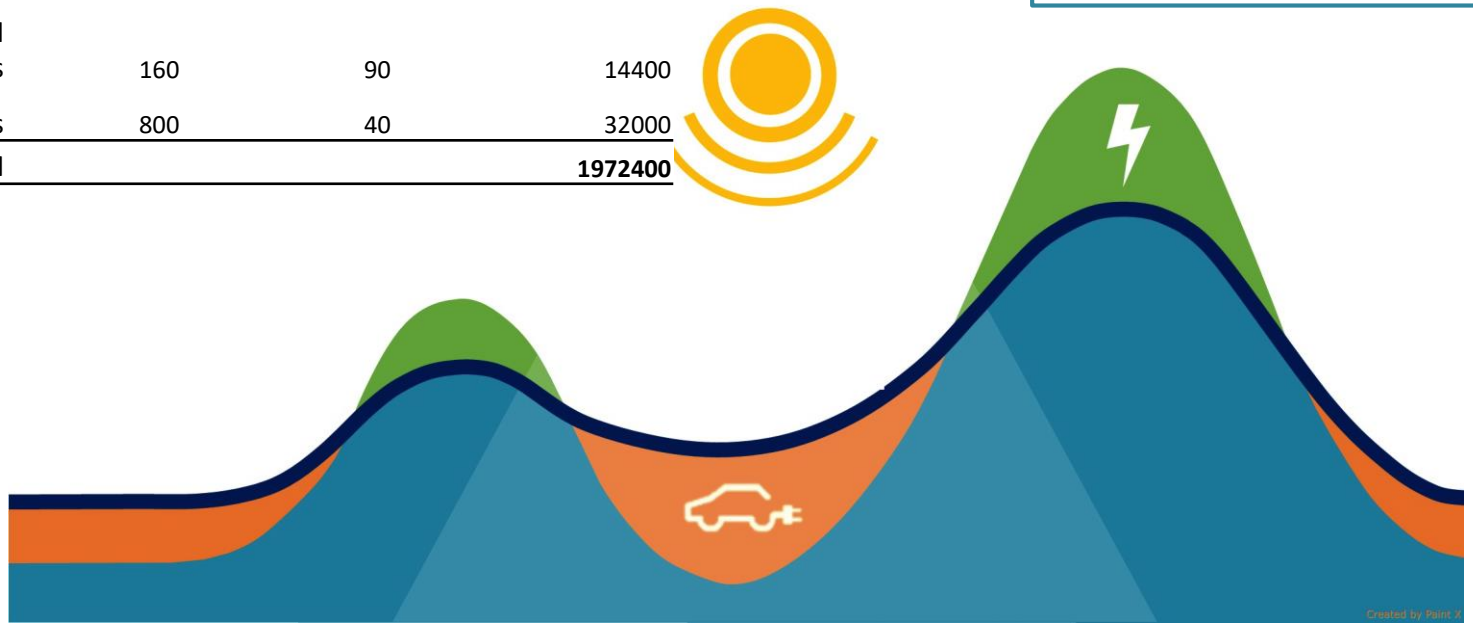
Could be plugged in to electricity network during this time

… which can be used for vehicle-to-grid

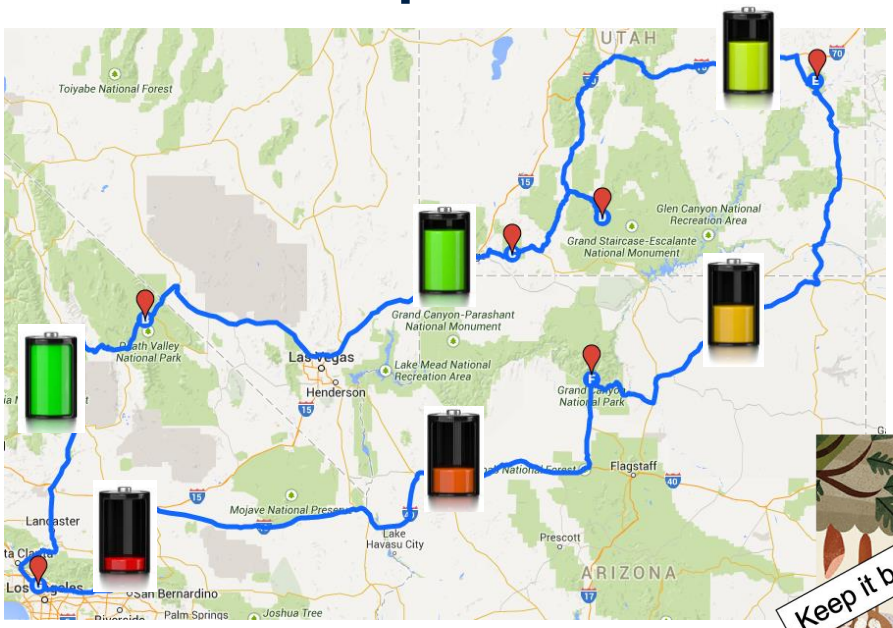
	Number (thousands)	Energy Capacity per vehicle (kWh)	Total Energy Capacity (GWh)
Cars	32970	50	1648500
Motorcycles	1370	20	27400
Light Goods Vehicles	4260	50	213000
Heavy Goods Vehicles	530	70	37100
Buses and coaches	160	90	14400
Other vehicles	800	40	32000
Total			**1972400**

Daily energy consumption UK: 1 TWh

Vehicles could power the country for two days.



Value depends on…



Technical constraints

Market availability

Vehicle-to-grid Challenges

- Battery degradation
- Customer engagement
- Changes to UK markets (TCR)
- Autonomous vehicles

THANK YOU

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